Firmware Development Using Agile Methodology

Comtrade used agile to develop firmware for a vehicle diagnostics and measurement instrumentation software.

Instead of waterfall methodology, which was commonly used in embedded systems projects in the past, Comtrade’s development team applied the agile approach to deliver a product that precisely matches the client’s expectations.

Using the agile approach, Comtrade implemented a modular, fully documented solution that can be easily upgraded or ported to next generation devices.

Challenges and Objectives

Our client, a provider of customized vehicle diagnostic systems, had signed a very demanding contract with a leading car manufacturer. The solution had to include design, development and production of hardware and software, and had to be integrated into an existing information and diagnostic system. The timeline was very aggressive with a fixed delivery date for the final product.

To meet the deadline, hardware, software and firmware had to be developed in parallel. The tight timeline required synchronized teams capable of delivering planned functionalities by established milestones. The performance requirements demanded part of the hardware to be realized with FPGA.
Introduction

Our Approach

Comtrade participated in the project for two years with a team of up to 15 engineers at peak times. Our developers were tasked with developing the entire product from scratch, while developing HW, SW and FW in parallel. The development was done offsite and across multiple locations.

Below is a comparison of how the project would have been done using the waterfall methodology and how it was actually carried out with agile approach.

<table>
<thead>
<tr>
<th>Project aspect</th>
<th>Traditional waterfall approach</th>
<th>Comtrade’s agile approach</th>
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<tbody>
<tr>
<td>Planning</td>
<td>Fixed dates, budget and features.</td>
<td>The final deadline remained fixed; however the scope was very flexible. Planning was repeatedly adapted during the project.</td>
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<td>Documentation</td>
<td>Extensive documentation that would take long to finish and would have to be changed later.</td>
<td>Our team started with a minimum amount of documentation, just barely enough to get the project started. High level requirements were obtained during the project.</td>
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<td>Requirements</td>
<td>Would have to be defined in advance and would be difficult to change later.</td>
<td>Features of the product were defined, but added later or changed frequently. We started with the most important features, while the client regularly revised priorities. Halfway through the project, the client decided to combine two products into a single one.</td>
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<td>Change requests</td>
<td>Would require a lot of administration and negotiations.</td>
<td>Responding to constant changes wasn’t difficult; changes were easily introduced in each new sprint.</td>
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<td>Customer involvement</td>
<td>Typically not needed during development; customer is involved only from the beta testing phase on.</td>
<td>At the end of each sprint, the Comtrade team had something to present to the client. The releases were frequent and were used by the client for expectation comparison.</td>
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<td>Development of HW/SW/FW</td>
<td>This would be done in parallel because interfaces are well defined with difficulties in the integration phase.</td>
<td>Development and integration were done in parallel with vital support of automatic testing.</td>
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<td>Team collaboration</td>
<td>Less collaboration, very formal, conducted through documentation and memos.</td>
<td>Informal and frequent team collaboration. Daily stand-up meetings, mandatory code reviews and discussions &amp; brainstorming were organized whenever needed. Close collaboration with HW and SW team in the client’s domain.</td>
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<td>Testing</td>
<td>Would be done in a separate phase, typically after development.</td>
<td>Comtrade used continuous integration and regression testing, supported with automated builds and an automatic testing system; custom HW was developed specifically for that purpose.</td>
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Comtrade delivered a state-of-the-art vehicle diagnostic device composed of measurement and test hardware, which is controlled by firmware and an industrial PC running the PC software. The device passed regulatory certifications for electronic devices and automotive diagnostic services. The final product helped strengthen our client’s leading position on the market, while the end-customer satisfaction was ensured with timely delivery through competent project management.

Using the agile approach, the Comtrade team implemented a modular, fully documented solution that can be easily upgraded or ported to next generation devices. The implementation was delivered on time, while the final product met all of the client’s expectations even though there were several changes in the requirements during the production stage.

The development of tests and test automation, which were created in parallel with the development, resulted in perfect documentation and testability. By introducing the automatic test system, our client achieved faster development cycles, which guarantee regression-free performance and drastically reduce testing costs.
Creating value through partnership

Comtrade is a leading IT organization in South East Europe specializing in the fields of IT solutions, system integration and hardware distribution. With more than 900 satisfied customers and offices across Europe and the USA, Comtrade has become a recognized name on the global stage. Founded in 1990, Comtrade now employs over 1,500 business and IT experts, including 1,000+ software engineers. With a proven track record of delivering IT solutions and services that help reduce business complexities and costs, we are a trusted technology partner to medium and enterprise businesses.

1500+ Total employees
30 Strategic partnerships
1000+ Software engineers
10 Development campuses
900+ Loyal customers
03 Technology centers

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